Math 155 — Epidemiology — Prof. Kaplan

An Annuity Game

Problem 1

You are 60 years old and need to put away money toward your retirement. You will retire at age 65 and want to have an annual income of $50,000.

How much money should you put away?

Here's a table of death probabilities for use in this problem:

Age	Probability of dying	cumulatively
65	0.1	0.1
70	0.1	0.2
75	0.1	0.3
80	0.3	0.6
85	0.1	0.7
90	0.1	0.8
95	0.1	0.9
100	0.05	0.95
105	0.05	1.00

The payments start at 65, unless you happen to have died at 65. Everybody is dead by 105, so 40 years the longest time you would need to draw on your retirement. The mean age at death is 82.25. The median is 80.

1. Write down how much money you will put aside at age 60 to support an annual income of $50K per year for the rest of your life.

2. You will then be given, at random, an age of actual death. (Sorry!) Calculate whether you had enough money in your savings to pay you the annual amount, and how many life-years you were without funds.

3. Score yourself. Your score will be

   - 2 million points minus the amount you put into savings. (So if you put more into savings, your score is lower ...)
   - Subtract from that 100,000 points times the number of life years you were without funds.

   Example: You saved $500,000 dollars and later found out that you died at age 80. Your savings are enough for 10 years, and you retired at age 65, so you ran out of money at age 75. This leaves you 5 years without funds. Your score is $2,000,000 - 500,000 - 5 \times 100,000 = 1,000,000$.

Note to Instructor:

Your actual age at death will be randomly selected from one of these values, which correspond to the probabilities in the table.

```
> ages = c(rep(c(65, 70, 75, 80, 80, 80, 85, 90, 95), each = 4),
+      rep(c(100, 105), each = 2))
> matrix(ages, nrow = 5)

     [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8]
[1,]   65   70   75   80   80   85   90   95
[2,]   65   70   75   80   80   85   90  100
[3,]   65   70   80   80   80   85   95  100
[4,]   65   75   80   80   80   90   95  105
[5,]   70   75   80   80   85   90   95  105
```